

One-Meter Class Drilling for Planetary Exploration, Phase II

Completed Technology Project (2009 - 2011)



Project Introduction

Robotic planetary exploration missions will need to perform in-situ analysis of rock and/or regolith samples or returning samples back to earth. Obtaining and delivering a sample can be a complex engineering problem, especially if it's done autonomously thousands of miles away. To accommodate future missions, these subsurface access and sample handling technologies must be developed to meet a broad range of potential requirements, including a variety of rock or subsurface materials, rigorous sample preservation requirements, and the general problem of autonomous operation in the presence of dust and with limited resources. The one-to-three meter range has been identified as a critical regime for planetary exploration and while there has been some technology development in this regime, there is currently no proven flight-like approach to robotically achieving this depth through layers of challenging material from realistic roving or landed platforms. The Phase 1 research has resulted in proving the benefits of rotary-percussive drilling system as it pertains to breaking of formation and cuttings transport. The primary objective of the proposed effort is to develop, via testing in a simulated Mars environment, a breadboard one-meter sampling drilling system for acquiring a small volume of drilled cuttings and a core (if necessary) from a target depth on Mars. This project would build on the existing knowledge base of Mars drilling, and its particular strength lies with its capability of performing drilling tests under simulated Martian conditions of temperature and pressure and CO₂ atmosphere. This is a component technology effort that includes the development of a rotary percussive drill head and a sampling lead drill string. Honeybee Robotics will leverage drill head development by utilizing voice coil percussive actuator technology developed by the Jet Propulsion Laboratory (JPL) for the Mars Science Laboratory Powder Drill.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

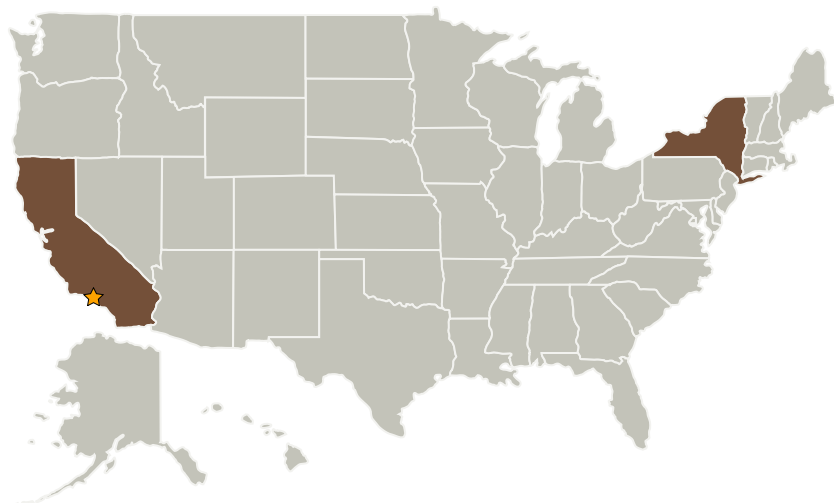
Small Business Innovation Research/Small Business Tech Transfer

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Primary U.S. Work Locations and Key Partners



Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX04 Robotic Systems
 - └ TX04.3 Manipulation
 - └ TX04.3.4 Sample Acquisition and Handling

Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Honeybee Robotics, Ltd.	Supporting Organization	Industry	Pasadena, California

Primary U.S. Work Locations

California	New York
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Project Transitions

**February 2009:** Project Start**September 2011:** Closed out